REPORT #
RRTAC 82-3

The Alberta Government's Reclamation Research Program – 1981

Heritage Fund

Alberta

LAND CONSERVATION AND
RECLAMATION COUNCIL
Reclamation Research
Technical Advisory Committee

Alberta

ENVIRONMENT

Environmental Coordination Services
Land Conservation and
Reclamation Council

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1 April 1982

Honourable John W. (Jack) Cookson,
Minister of the Environment,
222 Legislature Building,
Edmonton, Alberta

Dear Sir:

Enclosed herein is the report "Alberta Government's Reclamation Research Program - 1981".

This Program Status Report was prepared by the Reclamation Research Technical Advisory Committee under the direction of the Land Conservation and Reclamation Council.

Yours very truly,

D.G. Harrington
Chairman, LCRC

Enclosure

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INTRODUCTION

The regulation of surface disturbances in Alberta is the responsibility of the Land Conservation and Reclamation Council. The Council executive consists of a chairman from the Department of the Environment and two deputy chairmen from the Department of Energy and Natural Resources. Among other functions, the Council oversees programs for reclamation of abandoned disturbances and reclamation research. The reclamation research program was established to provide answers to the many practical questions which arise in reclamation. Funds for implementing both the operational and research programs are drawn from Alberta's Heritage Savings Trust Fund.

To assist in technical matters related to the development and administration of the research program the Council appointed the Reclamation Research Technical Advisory Committee (RRTAC). The Committee first met in March, 1978 and consists of eight members representing the Alberta Departments of Agriculture, Energy and Natural Resources, Environment and the Alberta Research Council. The Committee meets regularly to up-date research priorities, review solicited and unsolicited research proposals, arrange workshops and otherwise act as a referral and coordinating body for reclamation research.

Additional information on the Reclamation Research Program may be obtained by contacting:

Dr. P.F. Ziemkiewicz, Chairman
Reclamation Research Technical Advisory Committee
Alberta Energy and Natural Resources
9915 - 108th Street
9th Floor, Petroleum Plaza, South Tower
EDMONTON, Alberta
(427-8042)

The following Reclamation Research Reports are available through:

Publication Services
Queen's Printer
11510 Kingsway Avenue
Edmonton, Alberta
T5G 0X5

Report #	Title	Price ($)
RRTAC 80-3	The Role of Organic Compounds in Salinization of Plains Coal Mining Sites. 46p.	$5.00 *
RRTAC 80-4	Proceedings: Workshop on Reconstruction of Forest Soils in Reclamation. 160p.	$5.00
RRTAC 80-5	Manual of Species Suitability for Reclamation in Alberta. 2 Vols. 560p.	$5.00
RRTAC 81-2	1980 Survey of Reclamation Activities in Alberta. 76p.	$5.00
RRTAC 81-3	Proceedings: Workshop on Coal Ash and Reclamation. 253p.	$5.00
RRTAC 82-1	Land Surface Reclamation: an International Bibliography. 2 Vols. 292p.	$5.00
RRTAC 82-2	A Bibliography of Baseline Studies in Alberta: Soils, Geology, Hydrogeology and Groundwater. 97p.	$5.00
RRTAC 82-3	The Alberta Government's Reclamation Research Program - 1981. 22p.	$5.00

* A $5.00 fee is charged for each publication to cover handling and postage.

Please make cheque payable to: Provincial Treasurer of Alberta

RECLAMATION IN ALBERTA

Most of Alberta's industrial activity occurs in three major biophysical regions: The Plains, where most of the Province's agricultural land is located, the Mountains and Foothills where recreation, forestry, wildlife and watershed values are predominant, and Northeast Alberta, where wildlife and forestry values exist.

Coinciding with these regions are three major disturbance types:

1) Plains: Coal mines operated in conjunction with electrical generating plants,
2) Mountains and Foothills: Metallurgical coal mines and high quality thermal coal for export, and
3) Northeast Alberta: Oil sand mining and extraction facilities.

While it is expected that research results will often have province-wide application, the division of the program among the three biophysical regions has proven helpful in identifying priorities and directions for the research program.

THE RESEARCH PROGRAM

Following is a summary of research projects as of March, 1982. Project titles are followed by the names of the principal investigators and their affiliation.

Upon project completion a final report is submitted. Some final reports are published intact as RRTAC Reports and released to the public. Others are held pending their inclusion in comprehensive reports. A list of available publications is appended.

1. PLAINS

Objectives

To return crop land to pre-mining levels of productivity. Productivity is taken to include both agricultural and hydrologic capabilities.

The Problem

Plains coal seams are usually overlain by bedrocks which contain a high proportion of swelling clays. When exposed to the elements the bedrock shales and sandstones break down into a material that is sticky when wet and cement-like when dry. This severely hinders plant growth and agricultural operations. Above the bedrock lie glacial deposits which are usually free of the most adverse properties of the bedrock though they lack the plant nutrients and organic matter characteristic of the overlying topsoil.

Rebuilding a soil profile is one of the major problems in cropland reclamation in Alberta. A soil must be built on levelled overburden which will be as productive as the original soil. Existing evidence indicates that placing topsoil and a buffering material over the spoil is the most efficient method for achieving this goal. However, we do not know how much capping material is needed. Also, where topsoils or subsoils are in short supply other amendments may be useful in soil building. In addition to soil reconstruction certain agricultural practices like green manuring and legume cropping may help rebuild the soil.

In many plains areas the coal seams are the major source of domestic water. What will happen when the coal is removed and overburden fills the mined-out pit? The behavior of the post-mining groundwater system will affect water users and could influence future agricultural potential. However, little is known about the effects of surface mining on groundwater in Alberta.

Approach

Recognizing the interaction between surface treatments and groundwater in determining eventual land productivity, RRTAC and members of the Coal Industry have developed a research program for the Plains which includes both agricultural and hydrologic aspects of reclamation. The projects are

designed so that the same basic experiments can be transferred to other sites on the Alberta Plains. These will yield consistent information and will facilitate policy-making and the development of regional reclamation standards and practices.

The expansion of mining on the south side of the Battle River near Forestburg, Alberta provided an excellent opportunity to establish a research program encompassing all phases of the mine-reclamation process. The following four studies dealing with groundwater and soil reconstruction comprise the Plains Coal Reclamation Research Program.

Projects

1. Restoration of Agricultural Productivity (79-6-SCH)
   R. Parker, Techman Ltd.

Grain and forage yields are being evaluated on a series of soil reconstruction plots at the Battle River Mining Area near Forestburg. Treatments include: depth of topsoil and buffering material over sodic spoil 0-3 m, use of bottom ash as an impediment to upward salt migration, use of coal ash and gypsum as soil amendments and reconstruction of topsoil using different horizons and mixtures. Salt migration on sloped spoils covered with 0.5 m of non-sodic overburden will also be studied. This is a co-operative study with Manalta Coal Ltd., Luscar Ltd., and Alberta Power Ltd. The project began in 1979 and may be expanded to include more mining sites in the future.

Status: The first crop was grown and plant and soil sampling began in 1981.

2. Plains Hydrology and Reclamation (79-2-MOR)
   S.R. Moran, Alberta Research Council

This study examines the impacts of surface mining on the regional groundwater, geology and soils. The main objectives include the identification of: 1) changes in groundwater quality and quantity after mining, 2) sources and release rates of groundwater contaminants (mainly salts), 3) changes in distribution of groundwater after mining.

(Will the groundwater carry salts to the surface, will the watertable drop or will the watertable re-establish at pre-mining levels?) and 4) surface stability after mining: subsidence, piping.

Critical groundwater and geologic parameters will be identified which may allow us to predict the "reclaimability" of a site prior to mining. This project began in 1979 and, like the previous one outlined in Item 1 will be expanded to other sites in the future.

Status: Monitoring equipment is in place and the detailed soil survey has been completed. Two years of hydrologic data have been collected north of Battle River, and one year at the south site.

3. Contribution of Groundwater Organic Compounds to Salinization in Plains Surface Mining (79-22-HOD)
G. W. Hodgson, University of Calgary

This literature review assessed significance of organic compounds in regulating the salinization of groundwater and soils after surface-mining.

Status: Completed

Results: Report #RRTAC 80-3

4. Biogeochemical Processes (79-27-HOD)
G.W. Hodgson, University of Calgary

This project examines the organic chemistry and microbiology of mine spoil salinization and was instituted to complement the inorganic chemistry approach taken in the Plains Hydrology Reclamation Project.

The combination of these studies will give us a clearer picture of the chemical, geological and groundwater factors which will, in the long run, determine the viability of agriculture on the post-mining landscape in Alberta.

Status: Completed

Results: Final Report 79-27-HOD

5. Physical and Chemical Changes in Stockpiled Topsoil (79-26-FUJ)
J. Fujikawa, Technical Development Branch, Alberta Environment

A topsoil stockpile near Bow City, Alberta, is being monitored along with undisturbed topsoil to determine whether adverse changes occur during storage. Ultimately this line of research will indicate how long topsoil can be stored before deterioration occurs.

Status: Ongoing

6. Integration of Wildlife and Agricultural Values in the Post-Mining Landscape (80-14-MAR)
B. Markham, Fish and Wildlife Division, Alta. Energy & Natural Resources

Surface Mining on the Plains will both eliminate and create wildlife habitat. This literature review will assess means of designing the post-mining landscape so that its value for wildlife and agriculture is maximized.

Status: Completed

Results: Final Report 80-14-MAR

7. Evaluation of Pipeline Reclamation Practices on Agricultural Land (81-1-HAS)
W.J. Hastie, Hardy Associates (1978) Ltd.

This study addressed the effects of construction and reclamation of three pipeline sizes: 56", 36" and 10". A description of the major types of pipeline construction and reclamation techniques associated with different pipe size or purpose will be prepared and their differences relative to surface disturbance noted for various soil zones, types, and agricultural land uses.

Status: Completed 31 March 1982
Results: Final Report 81-1-HAS

II. MOUNTAINS AND FOOTHILLS

Objectives

1) Control of erosion on a wide variety of disturbances including coal mines, mineral exploration sites, coal ash pits and oil and gas well sites.

2) Return of forested lands to previous levels of productivity.

3) Return of wildlife range to previous levels of productivity.

The Problems

Reclamationists in the mountains and foothills face a wide variety of conditions. While some foothill sites are characterized by subdued terrain and moderate climate, other sites, particularly in the mountains, present steep slopes, rocky spoil and a short growing season. On these problem sites summer droughts, chinook winds, erodible slopes and nutrient-poor soils are common.

On lower elevation foothill sites reclamation is expected to yield forests with commercial potential while on the higher elevation mountain sites erosion control, development of wildlife habitat and recreation potential are the reclamation objectives.

Reclaimed land in the mountains and foothills will not be as intensively managed as reclaimed agricultural lands would be. Also, topsoil tends to be thin and difficult to handle selectively. So, reclamation must prepare a site such that a plant-soil system will develop which will perform its land use expectations without indefinite maintenance.

Four major problem areas have been identified: 1) Development of native grasses and woody species for high elevations 2) Reconstruction of native soils or development of soils on raw overburden 3) Grass establishment on exposed sites 4) tree and shrub establishment in erosion controlling vegetation.

Approach

Reclamation Research in the mountains and foothills seeks to identify and develop plant materials and reclamation techniques which will meet the desired end land use with minimum or no maintenance. Research topics include development of native grasses for reclamation of high elevation disturbances, establishment of grasses, trees and shrubs on harsh sites and fertilizer management to promote development of stable plant-soil systems.

Projects

1. Selection of Native Grasses for Reclamation (79-7-WEI)
R. Sadasivaiah, University of Alberta

Many alpine and subalpine sites are difficult to reclaim simply because commercially available grasses and legumes either cannot survive or reproduce in the short growing season. This study is selecting lines of native grasses which are known to invade disturbances in the subalpine and alpine. Selections are made on the basis of commercial potential and fitness for reclamation.

Status: Ongoing

Results: Three lines of Agropyron species are presently undergoing licencing application with The Canadian Department of Agriculture.

2. Native Grasses for Reclamation: Selected Line Adaptability Trails (79-23-WEI)
P. Ziemkiewicz, Alberta Energy and Natural Resources

By early 1979 the above study had produced nine selected lines of

native grass species. To ensure that the selected lines had not lost their tolerance to high-elevation conditions in the process of development, a series of test plots was established: 1) to evaluate their fitness to subalpine and alpine conditions, 2) to compare their performance with selected agronomic grasses and 3) to evaluate their respective fertilizer requirements.

Status: Ongoing

Results: Report #RRTAC 80-1

3. Uptake of Nitrogen by Native Grasses (78-3-M/P)
D. Paton, University of Alberta

It is often assumed that native grasses require less nutrient than their agronomic counterparts. This study compared the nitrogen uptake rates of native and agronomic grasses to learn more about their nutrient requirements.

Status: Completed

Results: Final Report 78-3-M/P

4. Optimization of Erosion Control and Reforestation Potential of Reclaimed Areas (79-16-MIH)
P. King, Alberta Forest Service

This study will identify the level of grass/legume cover which will prevent erosion yet permit tree seedling growth. This study will also identify methods for predicting the optimal levels of herbaceous cover.

Status: Ongoing

5. Use of Mat Mulches (79-17-TAK)
S.K. Takyi, Alberta Forest Service

On particularly exposed sites, where high wind and solar radiation hinder plant establishment, artificial soil covering may aid reclamation.

This study evaluates the relative effectiveness of various roll-out mat mulches and ridging treatments on exposed coal spoil.

Status: Ongoing

Results: ENR Report #152

6. Evaluation of Native-Agronomic Grass/Legume Mixes for Reclamation of Subalpine Disturbances (78-18-RUS)
H. Tomm, Alberta Forest Service

Certain agronomic grasses and legumes are known to quickly establish an erosion-controlling cover while native grasses generally grow more slowly. This experiment tests which of several native/agronomic seed mixes provides the best combination of erosion-control and long-term stability.

Status: Ongoing

7. Methods for Establishing Native Grass on Unamended Coal Spoil (80-11-TAK)
S.K. Takyi, Alberta Forest Service

This study compares different seeding methods for native grass mixes (hydroseeding, broadcasting and raking, simulated drilling). Also various erosion-controlling mats and mulches are evaluated.

Status: Ongoing

8. Native Shrub Seed Propagation Testing Project (80-16-KIN)
P. King, Alberta Forest Service

Methods for collecting, handling and treating seed of native shrub species with potential for reclamation will be evaluated to maximize propagation success.

Status: Ongoing

9. Revegetation of Ash Disposal Areas, Grande Cache (79-1-MAC)
T.M. Macyk, Alberta Research Council

This project will test depths of overburden required to revegetate these disposal sites. Also, ash-overburden mixtures, will be examined.

Status: Ongoing

III NORTHEAST ALBERTA

Objectives

1) To develop techniques whereby a self-sustaining, erosion-free cover can be established on oil sand tailings pond dykes.
2) To return tailings sand storage and overburden dumps to productive forest.

The Problem

Northeast Alberta contains all of Canada's surface-mineable oil sands. Extraction of this valuable petroleum resource presents several problems for reclamation. By far the greatest problem lies with the tailings disposal systems currently employed.

At the end of its 25 year life a typical oil sand plant producing 19 900 cubic meters per day (125 000 barrels per day) of synthetic crude oil will require a 22 to 31 square kilometer (8.5 to 12 square miles) tailing pond. The liquid contents of the pond will consist primarily of 360 million cubic meters of sludge. Estimates on the time required for the sludge to solidify vary from hundreds to thousands of years. The sludge will be impounded behind dykes built of tailings sand. Dyke heights will reach from 55 to 100 meters above ground level. Erosion protection will be provided by a cover of grasses, legumes and shrubs. Because the tailings sand is devoid of nutrient and drains rapidly, amending materials (Muskeg, certain mineral overburdens) will be added to begin development of a soil.

Pits left after mining will be filled with tailings sand and overburden dumps will be constructed. These sites will also be reclaimed to a designated land use. Soil reconstruction and woody plant establishment in particular need further research.

Approach

As in the Mountains and Foothills, proper reclamation in Northeast Alberta will produce landform and plant community combinations which will fulfill their land use requirements without indefinite maintenance.

In order to pool resources and avoid duplication of effort, RRTAC and the industry's Oil Sands Environmental Study Group (OSESG) have initiated a joint Reclamation Research Program. Three priority areas have been identified:

1) Wood Plant Research
2) Soil Reconstruction
3) Equipment Development

A Woody Plant Research Program is now underway and we are presently developing a Soil Reconstruction Research Program.

Projects

1. Soil Reclamation Study: Phase 1
   Literature Review (79-24-OSE)
   R. Johnson, Montreal Engineering Co. Ltd.

This is a joint OSESG/RRTAC project aimed at identifying available soil-building materials in the Oil Sands area and developing methods of combining these materials into productive soils. Phase 1, which is a literature review and analysis of existing information was funded in 1979/80. It is intended that this will be followed by one or more experimental phases in succeeding years.

Status: Completed

Results: Final Report 79-24-OSE

2. Selection of Tree and Shrub Varieties for Oil Sand Reclamation (79-13-DUN)
S.K. Takyi, P. King, Alberta Forest Service

In 1979 a test site in the oil sands area was planted with varieties of native and exotic tree and shrub species to help select those varieties suitable for oil sands reclamation.

Status: Ongoing

3. Micorrhizal Potential in Reconstructed Soils (81-2-PAR)
D. Parkinson, University of Calgary

Micorrhizal Fungi nearly always enhance tree nutrition. This project will determine the survival and inoculum potential of Mycorrhizal Fungi in undisturbed and stockpiled peat to be used in oil sand tailing reclamation. Also, Fungal species will be selected for use in Jack Pine inoculation programs and mycorrhizal development will be monitored in field trials.

Status: Ongoing

4. Reinstatement of Biological Activity in Reconstructed Soils (81-3-PAR)
D. Parkinson, University of Calgary

This project examines a number of objectives dealing with soil reconstruction in the Oil Sands and will also contribute to the top-soil stockpile project at Bow City.

Status: Completed

Results: Final Report 81-3-PAR

IV GENERAL

A number of projects will yield results applicable to reclamation problems throughout Alberta. These projects are listed below.

Projects

1. Reclamation Review (78-6-SIM)
   H.P. Sims, Alberta Environment

This project will compile information from the international reclamation literature pertinent to Alberta. The Reclamation Review will not only serve as a handbook of reclamation techniques, it will also identify gaps in our reclamation knowledge and point the way for future research.

Status: Bibliography Completed
Results: Published Report #RRTAC 82-1

2. Cross Reference for Reclamation Review (80-13-WAL)
   D.G. Walker, David Walker Assoc. Ltd.

This project will provide a cross reference of keywords, authors and subjects as part of the Reclamation Review.

Status: Completed
Results: Published in Report #RRTAC 82-1

3. Establishment of Biological Activity in Oil Sands Trailings and Coal Mining Overburden (78-4-PAR)
   D. Parkinson, University of Calgary

This study looks at the nature and rate of micro-organism establishment in spoils and the influence of various reclamation treatments in establishing a stable plant-soil system. The project includes both laboratory and field work and studies spoils produced by Plains Coal Mining, Mountain and Foothills Coal Mining as well as Oil Sand Mining and extraction.

Status: Completed

Results: Final Report 78-4-PAR

4. Species Suitability Manual (79-5-W/P)
L.E. Watson, Techman Ltd.

This manual catalogued available information on the many species used or useable in reclamation. This will help Reclamationists design seed mixes which are better adapted to their particular needs.

Status: Completed

Results: Published Report #RRTAC 80-5 Vol. I Grasses
Vol. II Forbs, Shrubs and Trees

5. Survey to Determine the Occurrence of Microbial N-fixing Root Sheaths (79-8-L/R)
M.J. Rowell, Norwest Soils Ltd.

Preliminary work suggested that root sheaths may be a significant source of N-fixation for grasses growing in nutrient-poor soils. This survey was commissioned to look for root sheath occurrence on reclaimed and undisturbed areas. Correlations were made between plant vigor and root sheath occurrence. N-fixing rhizosheaths were found on grasses growing on disturbed sites more commonly than on undisturbed sites. Laboratory studies funded by the Alberta Environment Research Trust (AERT) are now underway to isolate and identify the N-fixing organisms. When available, the resulting innocula will be tested under field conditions to determine whether they have value as a reclamation treatment.

Status: Completed

Results: Final Report 79-8-L/R

6. Chemical Characterization of Bottom Ash and Fly Ash from four Alberta Power Stations (78-2-MCC)
D. McCoy, Technical Development Branch, Alberta Environment

Samples were collected over a period of time and analysed to determine if fly and bottom ash chemistry varied among the various coal seams and power plants, and whether ash from a given source varies significantly through time.

Status: Completed

Results: Published in Report #RRTAC 82-3

7. Plant Nutrient-Agronomic Potential of Coal Ash (78-20-MCC)
D. McCoy, Technical Development Branch, Alberta Environment

Various rates of fly ash and bottom ash were mixed with two soils and a sodic spoil to determine whether ash addition can enhance growth of barley and alfalfa.

Status: Completed

Results: Published in Report #RRTAC 82-3

8. Radioactivity in Fly Ash (80-19-MCC)
D. McCoy, Technical Development Branch, Alberta Environment

Levels of radioactivity in fly ash from several power plants in Alberta were surveyed.

Status: Completed

Results: Final Report 80-19-MCC

9. Reclamation Activities in Alberta (80-15-SIM)
H.P. Sims, Alberta Environment

Reclamation and reclamation research activity in Alberta were surveyed and presented in report form.

Status: Completed

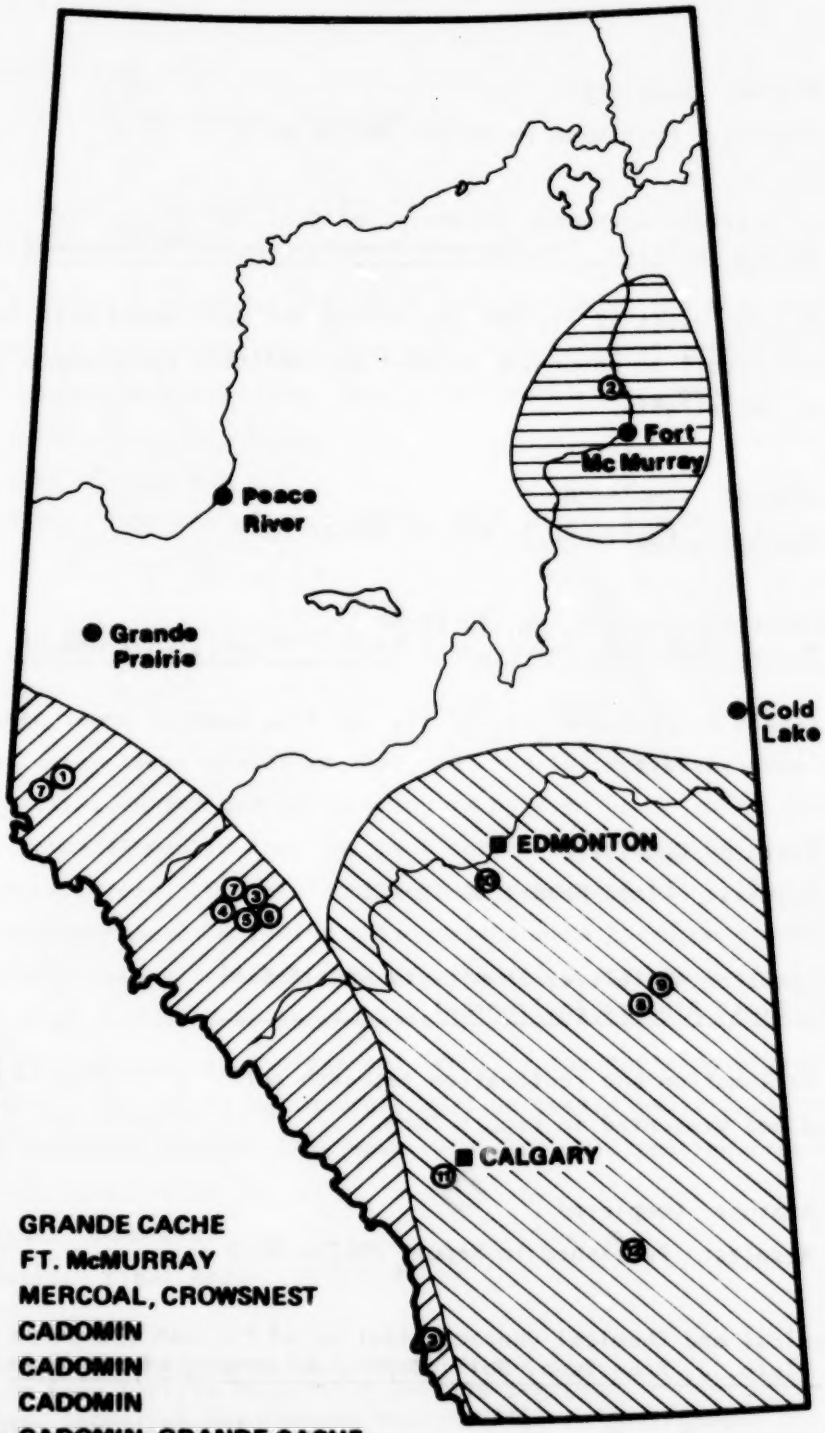
Results: Published in Report #RRTAC 81-2

10. Physical and Chemical Characterization of Fly Ash (78-5-P/R
D. Pluth, J. Robertson, Soils Dept., University of Alberta

Fly ash from five sources around Alberta were surveyed for physical chemical properties. Plant toxicities were evaluated in greenhouse studies.

Status: Completed

Results: Published in Report #RRTAC 82-3



LOCATION OF FIELD PLOTS

1 - 79 - 1 - MAC	GRANDE CACHE
2 - 79 - 13 - DUN	FT. McMURRAY
3 - 79 - 16 - MIH	MERCOAL, CROWSNEST
4 - 79 - 17 - TAK	CADOMIN
5 - 79 - 18 - RUS	CADOMIN
6 - 80 - 11 - TAK	CADOMIN
7 - 79 - 23 - WEI	CADOMIN, GRANDE CACHE
8 - 79 - 2 - MOR	FORESTBURG (BATTLE RIVER)
9 - 79 - 6 - SCH	FORESTBURG (BATTLE RIVER)
10 - 79 - 7 - WEI	ELLERSLIE
11 - 78 - 4 - PAR	CALGARY
12 - 79 - 28 - FUJ	BOW CITY

– PLAINS

– MOUNTAINS AND FOOTHILLS

– NORTHEAST OIL SANDS

RESEARCH PROJECTS 1981-82

Managing Agency (Research Organization Principal Investigator)	Project #	Research Subject	RRTAC Budget $ (1981-82)	
Alberta Agriculture				
(Hardy Assoc. Ltd., J. Hastie)	81-1-HAS	Evaluation of Pipeline Reclamation Practices in Agricultural Land	40,120	
Alberta Energy and Natural Resources Alberta Forest Service				
(Alberta Research Council T.M. Macyk)	79-1-MAC	Revegetation of Ash Disposal Pits, McIntyre Mines, Grande Cache	17,200	1
(Alberta Forest Service S.K. Takyi, P. King)	79-13-DUN	Selection of Woody Plants for Oil Sand Reclamation	0	2
(Alberta Forest Service P. King)	79-16-MIH	Establishment of Tree and Shrub Seedlings in Erosion Controlling Cover, Coal Valley, Crowsnest	0	
(Alberta Forest Service S.K. Takyi)	79-17-TAK	Use of Mat Mulches on Difficult Slopes, Cadomin.	0	
(Alberta Forest Service H. Tomm)	79-18-RUS	Evaluation of Native-Agronomic Grass and Legume Mixes, Cadomin.	0	
(Alberta Forest Service S.K. Takyi)	80-11-TAK	Methods of Establishing Native Grass on Unamended Coal Spoil, Cadomin	0	
(Alberta Forest Service P. King)	80-16-KIN	Native Shrub Seed Propagation Testing Project	2,000	

Managing Agency (Research Organization Principal Investigator	Project #	Research Subject	RRTAC Budget $ (1981-82)	
Alberta Energy and Natural Resources Scientific and Engineering Services				
(Scientific and Engineering Services P.F. Ziemkiewicz)	79-23-WEI	Selected Lines of Native Grasses Alpine and Subalpine Test Plots	0	
Alberta Environment Research Management Division				
(Research Management Division H.P. Sims)	78-6-SIM	Review and Presentation of Reclamation Information Pertinent to Alberta	0	
(Alberta Research Council S.R. Moran)	79-2-MOR	Hydrologic Impacts of Plains Surface Coal Mining, Forestburg	1,065,526	
(Techman Ltd. R. Parker)	79-6-SCH	Techniques for Restoring Crop Production after Surface Mining, Forestburg	32,212	3
(Kananaskis Centre, U. of Calgary G.W. Hodgson)	79-27-HOD	Biogeochemical Processes in Plains Coal Mine Spoil	93,200	
(Genetics Dept., Univ. of Calgary R. Sadasivaiah)	79-7-WEI	Development of Native Grasses for Reclamation	140,866	4
(David Walker Assoc. Ltd. D.G. Walker)	80-13-WAL	Development of Cross-Reference Systems for 78-6-SIM	2,000	
(Biology Dept., Univ. of Calgary D. Parkinson)	81-2-PAR	Micorrhizal Development in Reconstructed Soils	41,485	
(Biology Dept., Univ. of Calgary D. Parkinson)	81-3-PAR	Reinstatement of Biological Activity in Severely Disturbed Soils	44,916	

Managing Agency (Research Organization Principal Investigator)	Project #	Research Subject	RRTAC Budget $ (1981-82)
Alberta Environment Technical Development Branch			
(Technical Development Branch J. Fujikawa)	79-26-FUJ	Physical and Chemical Changes in Stockpiled Topsoil	20,000
		T O T A L	$1,499,525

1/ Cooperatively funded with McIntyre Mines Ltd.
2/ Projects requiring no RRTAC Budget are fully funded by the Managing Agency
3/ Cooperatively funded with Alberta Power Ltd., Luscar Ltd. and Manalta Coal
4/ Cooperatively funded with Parks Canada

PROGRESS IN FULFILLING RESEARCH PRIORITIES

PROGRAM AREA	PRIORITIES			RESEARCH PROJECT
Plains Agricultural Lands	Physical Problems	Hydrogeology	- 79-2-MOR	Plains Hydrology and Reclamation Study
			- 79-22-HOD*	Literature Review: Effects of Organic Compounds on [illegible]ization
			- 79-27-HOD*	Biogeochemical Processes in Salinization
		Ash Disposal	- 79-1-MAC	Revegetation of Ash Disposal Sites
			- 78-2-MCC*	Variability of Coal Ash
			- 78-20-MCC*	Greenhouse Study: Crop Tolerance to Ash in Three Soil Types
			- 78-5-P/R*	Chemistry and Physical Characteristics of Fly Ash
			- 82-5-LES+	Bottom and Fly Ash as Amendment to Sodic Spoils
			- 80-19-MCC*	Radioactivity in Coal Ash
		Overburden Classification	- 79-2-MOR	Weathering Products of Spoils - Inorganic Chemistry
			- 79-27-HOD*	Weathering Products of Spoils - Organic Chemistry
		Erosion Control	- 82-5-LES+	Stability of Topsoil over Sodic Spoil Slopes
			- 82-9-LLO	Establishment of Plant Cover on Dry Sandy Sites in S.E. Alberta
		Landscape Design	- 80-14-MAR*	Integration of Wildlife and Agricultural Values in the Post-Mining Landscape.
			- 79-2-MOR	Landscape Design for Optimal Ground Water Quality and Productivity
		Pipelines	- 81-1-HAS *	Evaluation of Pipeline Reclamation Practices on Agricultural Land
	Biological Problems	Soil Reconstruction	- 82-5-LES+	Reclamation of Sodic Spoils, Reconstruction of Torlea Solonetzic Soils
			- 79-26-FUJ	Chemical Changes in Stockpiled Topsoil
			- 78-4-PAR*	Biological Activity in Stockpiled Topsoil
	Cultural Practices	Cropping Systems	- 82-5-LES+	Effects of Small Grain vs Forage Crops on Reconstructed Soils

*Project Completed by 31 March 1982
+Cooperative project with Alberta Power, Manalta Coal and Forestburg Collieries

PROGRAM AREAS	PRIORITIES			RESEARCH PROJECT
Mountains & Foothills Coal Mining	Physical Problems	Coal Ash Disposal	- 79-1-MAC +	Revegetation of ash disposal pits. McIntyre Mines, Grande Cache
		Drill Site Reclamation	- 78-1-LAR*	Survey of revegetation success on abandoned oil exploration sites.
	Biological Problems	Ecology	- 78-3-M/P*	Nutrient uptake rates of Native and Agronomic grasses.
			- 79-8-L/R*	Occurrance of nitrogen-fixing root sheaths on grasses growing in disturbed soils.
			- 82-11-Z/J	Factors Affecting Development of a Stable Nutrient Cycle.
		Native Species	- 79-7-WEI	Development of Native grasses for reclamation.
			- 79-23-WEI	Alpine and Subalpine test plots for native grass lines
			- 79-5-W/P*	Manual of Grasses, Forbs, Trees and Shrubs for Reclamation in Alberta.
			- 80-16-KIN*	Seed pretreatments for native shrub propagation
			- 82-12-TOM	Survey of A.F.S. Native Grass Trials.
		Soil Reconstruction	- Company Projects	
			Coal Valley	Materials suitability plots (topsoil blend, spoil), soil depth plots (Capping depths of Topsoil/Subsoil from 0-60 cm). Lodgepole pine seedling performance will be monitored on each treatment. Luscar Ltd.
			Obed-Marsh	Forest soil reconstruction plots. Various sequences for rebuilding forest soil will be monitored in terms of Lodgepole pine, white spruce seedling performance. Union Oil of Canada Ltd.
	Cultural Problems	Planting	- 79-16-MIH	Establishment of tree and shrub seedlings in erosion controlling cover, Coal Valley, Crowsnest.
			- 79-18-RUS	Evaluation of Native-Agronomic grass and legume mixes, Cadomin.
		Fertilization	- 79-23-WEI	Native and Agronomic species' nutrient requirements
			78-4-PAR*	Effects of various types of fertilizer on tree and grass performance
		Mulches	- 79-17-TAK	Use of Mat Mulches on difficult slopes, Cadomin.
			- 78-4-PAR*	Effects of peat amendment on tree and grass performance
			- 80-11-TAK	Methods of establishing native grass on unamended coal spoil, Cadomin.

*Project Completed by 31 March 1982
+Cooperative Project with McIntyre Mines Ltd.

PROGRAM AREA		PRIORITIES			RESEARCH PROJECT
Oil Sands	Biological Problems	Soil Reconstruction	-	79-24-OSE*	Literature Review: Soil properties required to meet Reclamation Objectives
			-	78-4-PAR*	Establishment of Biological Activity in Disturbed Soils
			-	81-2-PAR	Micorrhizal Potential in Reconstructed Soils
			-	81-3-PAR*	Reinstatement of Biological Activity in Reconstructed Soils
		Shrubs and Trees Selection Propagation	-	79-13-DUN	Selection of Suitable Native Shrubs for Reclamation
			-	81-5-K/C+	Review of Shrub and tree propagation techniques
			-	81-6-K/K+	Shrub seed collection
		Ecology	-	Under Development with OSESG 1/	
		Equipment Development	-	Under Development with OSESG	
	Cultural Problems	Shrubs and Trees Establishment and Management	-	81-4-P/F+	Review of establishment and maintenance literature
			-	81-6-T/D+	Development of sampling program for shrub studies

*Project Completed by 31 March 1982
1/ OSESG = Oil Sands Environmental Study Group
+Cooperative Project with OSESG